other, and assuming various fantastic shapes. The total surface of ice and rock is 8,874 square metres, that of the former being 7,171 square metres, of the latter 1,703 square metres; the mass of the ice amounts to 125,000 cubic metres.

The cavern consists of two parts, an upper and lower stage; the former is reached immediately after leaving the entrance, its floor being formed of ice, its roof and walls of limestone; it is partially divided into two unequal chambers, the small and great saloons (Fig. 1), by a curtain of rock descending from the roof. The small saloon is not situated on the same level as the great saloon. In the great saloon are three ice pillars (Fig. 1); they are translucent, and down the cylindrical hollow of one pillar there is a continuous though small flow of water; in addition there are numerous other ice ornaments which have received fanciful names. The eastern end of the saloon is contracted into a very narrow corner; at this point there has been a landslip corresponding to a crater-shaped depression in the slope of the Duosa Mountain, in which the cavern is situated. In the small saloon to the right of the entrance is a waterfall composed entirely of ice.

The lower stage consists of a corridor (Fig. 2) following the south side wall of the saloon; the downward prolongation of the dome-shaped rock wall of the saloon forms the south corridor wall, while the naturally formed cross-section of the ice constitutes the northern. The corridor originally consisted of two portions, a right and left wing, separated by a mass of ice; this has now been bored through. The entire length of the corridor is 200 metres.

The right corridor wing is reached from the small saloon by going down a steep flight of steps through a natural opening; the mass of ice whose upper surface forms the floor of the saloon after touching the roof suddenly terminates so as to make a nearly vertical wall to the corridor; the floor of the latter sinks down into the depths below, terminating in a mass of *débris*; this point probably forms a natural outlet for the water.

In the left corridor-wing is a magnificent ice structure termed the Grotto (Fig. 3).

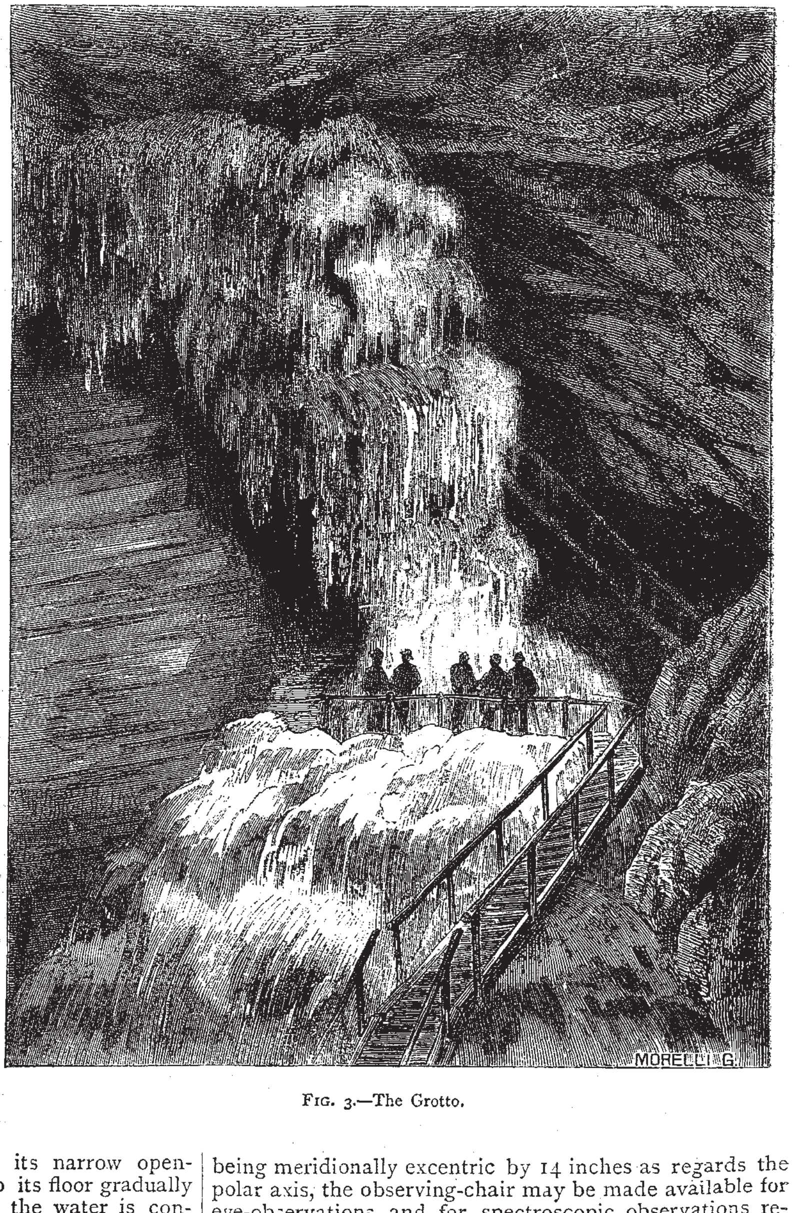

Fig. 3.—The Grotto.

The cooling of the air and the permanent low temperature (the mean of the year being −·86° C.) of the cavern are due to its height and northern aspect, as well as to its narrow opening and contracted exit canal, and to its floor gradually sloping inwards; as a result of this, the water is converted into ice, and the permanence of the latter thus insured.

Through the kindness of Herr Ruffiny, the discoverer, and Dr. Pelech, I have been enabled to obtain the loan of the woodcuts.

W. Bezant Lowe

THE VISITATION OF THE ROYAL OBSERVATORY

On Saturday last the annual visitation of the Royal Observatory was held, when the Astronomer-Royal read his annual report, which refers to a period of thirteen lunations, from the new moon of 1878, May 2, to the new moon of 1879, May 20. We notice some of the most important points in this report:—

Considerable alterations have been made in the great equatorial, so as to make the instrument easy for use with the long half-prism spectroscope. The declination axis being meridionally excentric by 14 inches as regards the polar axis, the observing-chair may be made available for eye-observations and for spectroscopic observations respectively, by reversing the instrument in hour-angle so as to take advantage of this excentricity.

With regard to the numerous group of minor planets, the Berlin authorities have most kindly given attention to the Astronomer-Royal's representation, and we have now a most admirable and comprehensive ephemeris.

The meridian observations of stars are directed primarily to the determination, with the greatest attainable accuracy, of the places of 215 fundamental stars observed throughout the day and night, and these are supplemented by observations of stars taken from a working catalogue of about 2,500 stars. About 1,300 of these stars were observed in 1878, forming a larger annual catalogue than usual.

As might have been expected, the Astronomer-Royal's report on the weather of the past year is not satisfactory. After a fine autumn, the weather in the past winter and spring has been remarkably bad. More than an entire lunation was lost with the transit-circle, no observation of the moon on the meridian having been possible between January 8 and March 1, a period of more than seven weeks. Neither sun nor stars were visible for eleven days, during which period the clock-times were carried on entirely by the preceding rate of the clock. The accumulated error at the end of this time did not exceed 0s.·3.

"During the past year, spectroscopic observations have been almost entirely suspended, in order that the reductions of accumulated photographic observations might proceed more rapidly. The sun's chromosphere has been examined on seven days only, and, on five of these, prominences were seen. Two measures of the displacement of the F-line in the spectrum of a Virginis, and 26 of the b lines in the spectra of 6 stars (3 of them not previously examined), as compared with the corresponding lines of hydrogen and magnesium, have been made. In five of these, though the stars were of the second magnitude only, a dispersive power equivalent to fifteen prisms of 60° was used. These observations were checked by reference to the F or b lines in the spectrum of the moon or of the sky. The spectrum of Brorsen's comet has been examined with the half-prism spectroscope, and that of the eclipsed moon on 1868, August 12, with the single-prism spectroscope.

"Photographs of the sun have been taken on 150 days, and 228 of these have been selected for preservation. The photographs show a complete absence of spots on 121 days out of 150; and on comparing them with those of the preceding year, when there was an absence of spots on 66 days out of 156, it appears that we have not yet passed the minimum.

"The following are the principal results for magnetic elements in the year 1878:—

Approximate mean westerly declination	18° 49′.
Mean horizontal force	3·905 (in English units). 1·801 (in Metric units).
Mean dip	67° 37′ 10″ (by 9-inch needles). 67 38 12 (by 6-inch needles). 67 38 59 (by 3-inch needles).

"The magnetic reductions for the years 1865 to 1876 are nearly completed. The results are exhibited in the form of annual and monthly mean curves of diurnal inequality, as in preceding investigations, the abscissæ showing the variation of magnetic declination, and the ordinates that of horizontal force, throughout the twenty-four hours. The annual curves of diurnal inequality are now complete for the period of thirty-six years, from 1841 to 1876; and from the great length of this series of observations," the Astronomer-Royal goes on to say, "all made on the same system and with similar instruments, most important inferences may be drawn, both as to the laws of diurnal inequality in general and its changes in different years and seasons, and as to the connection between magnetic phenomena and sun-spots. These annual curves show a well-marked change in close correspondence with the number of sun-spots. About the epoch of maximum of sun-spots they are large and nearly circular, having the same character as the curves for the summer months; whilst about the time of sun-spot minimum they are small and lemniscate-shaped, with a striking resemblance to the curves for the winter months. We think with the Astronomer-Royal that it may be worthy the consideration of the Board whether the whole of these results, with any modifications that experience suggests, should not be printed and circulated as a separate volume.

"The monthly curves, 1865-76, have been formed for three periods of four years each, corresponding roughly to periods of minimum, maximum, and mean of sun-spots, and the whole series stands thus (the general character of the curves being added):—1841-47 (curves) mean; 1848-57, small; 1858-63, large in summer, small in winter; 1865-68, small; 1869-72, very large; 1873-76, mean. The maxima of sun-spots occurred in 1848, 1860, and 1870, and the minima in 1844, 1856, and probably in 1879.

"The connection between changes of terrestrial magnetism and sun-spots," the Astronomer-Royal states, 'is shown in a still more striking manner by a comparison which Mr. Ellis has made between the monthly means of the diurnal range of declination and horizontal force, and Dr. R. Wolf's "relative numbers" for frequency of sun-spots. It appears from this that not only is there a general correspondence in the two sets of phenomena, but that the minor irregularities of the sun-spot curve are reproduced in the curves of diurnal magnetic range; and further that the well-marked annual inequality in the latter is itself variable, being greatest at the time of maximum of sun-spots and least at that of minimum. It will be an interesting inquiry, when sun-spots become more numerous, to determine whether the present paucity of earth-currents is connected with the fewness of spots."

The Astronomer-Royal, by these researches, has endorsed the work we owe to Sabine, Broun, Stewart, and others.

The Report states that the Westminster clock has not been quite so well regulated as usual. During the period to which this Report refers, its error exceeded 1s. on 77 days; on 15 of these it was between 2s. and 3s., on 4 between 3s. and 4s., and on 1 day it exceeded 4s.

With regard to the last Transit of Venus results, the past year has been occupied in putting reports and calculations in a shape adapted to eventual printing of the account of the whole enterprise. With regard to the Transit of 1882, the Astronomer-Royal informs us that the general impression appears to be that it will be best to confine observations to simple telescopic observations or mcirometer observations at ingress and egress, if possible at places whose longitudes are known. For the first phenomenon (accelerated ingress) the choice of stations is not good; but for the other phenomena (retarded ingress, accelerated egress, retarded egress), there appears to be no difficulty. The adoption of a south-polar station seems to be practically abandoned.

With regard to the numerical lunar theory, the Report states that the incessant pressure of the business of the observatory has prevented the Astronomer-Royal advancing so rapidly as he had hoped. "The solar perturbing forces are all computed to 10^{-7} in all cases, and to 10^{-8} and 10^{-9} in those cases in which large factors are introduced by theory as necessary for obtaining the correction to tabular coefficients from discordance of computed deductions (lunar places on one side, with solar forces on the other). The lunar places with the same arguments, first computed to 10^{-7}, are now extended to 10^{-8} or 10^{-9}, for the powers of radius vector. The computations of the same kind for the other assumed elements (longitude and latitude) are not begun. In regard to the discordance of annual equation, to which I called attention in the last Report, I suspend my judgment. I have now discussed the theory completely; and, in going into details of secular changes, I am at this time engaged on that which is the foundation of all, namely, the change of excentricity of the solar orbit, and its result in producing lunar acceleration."

With reference to the practicability of reducing the extent of the printed volume of "Greenwich Observations," the report concludes with some of the suggestions that have been made by certain members of the Board. The introduction, it has been suggested, might to some extent be stereotyped. No reduction, it is thought, should be made, in regard to the details of meridional and altazimuth observations.

To the strong appeal made for extension of the spectroscopic observation of stars, in reference to their motion in the line of sight, the Astronomer-Royal has given a tacit response by the modification of the S. E. Equatorial, so as to facilitate that extension. "The tendency of external scientific movement," he remarks, "is to give great attention to the phenomena of the solar disk (in which this observatory ought undoubtedly to bear its part). And I personally am most unwilling to recede from the existing course of magnetical and meteorological observations. All these, however, are inferior in importance, with regard to the question now before us, to the extent of printing the original details of astronomical observations."

"The general tendency of these considerations is," the report concludes, "to increase the annual expenses of the Observatory. And so it has been, almost continuously, for the last forty-two years. The annual ordinary expenses are now between two and a half and three times as great as in my first years at the Royal Observatory. I would fain flatter myself that the value of its results has increased in a greater degree."

NATURAL SCIENCE DEGREES AT OXFORD

DR. ODLING, replying in the *Times* to Canon Liddon's letter, referred to in NATURE, vol. xx. p. 132, maintains that unless some little Greek is considered absolutely essential to a liberal education, there can be no ground for refusing a degree in arts to students who, though unacquainted with Greek, are familiar with such like studies as geometry, arithmetic, and astronomy, which equally with grammar, dialectics, and rhetoric, have been counted from time immemorial among the liberal arts. And assuming the compulsory modicum of Greek now brought up by mathematical and natural science students to be a non-essential element of their liberal education, as certified to by a degree in arts, how can a degree in arts be hereafter refused to advanced students of either of these subjects who, while still bringing up Latin, shall in future offer a considerable amount of German, together with some amount of both mathematics and natural science as a substitute for the present modicum of Greek?

Dr. Odling, rather than degrade science by awarding its graduates an inferior degree, seems disposed to retain the little modicum of Greek at present required for a pass; he would have been contented with Canon Liddon if the existing arrangements had been undisturbed. His objection is not to the incubus of Greek, but to the slur about to be put on natural science.

Canon Liddon replies that, in speaking of the educational advantages of Greek, he was in part thinking of the *minimum*. He believes Dr. Odling mistaken in thinking that the new degree was intended as anything but an honourable distinction. No one could suppose, he believes, that the majority of the present Council could be unfriendly to physical science. The statute appeared to him to be drawn almost exclusively in the interests of natural science students, and with a view to relieving them of an uncongenial study.

In a subsequent letter Dr. Odling quotes a passage from a lecture delivered by Dr. Whewell some twenty-five years ago. In the course of showing that the great contributions made to intellectual education by Greece, Rome, and modern Europe in succession have been geometry, jurisprudence, and physical science respectively, he wrote as follows:—

"Our intellectual education now, to be worthy of the time, ought to include in its compass elements contributed to it by every one of the great epochs of mental energy which the world has seen. . . . A mind well disciplined in elementary geometry and in general jurisprudence would be as well prepared as mere discipline can make a mind for most trains of human speculation and reasoning. . . . But however perfectly the habits of deduction may be taught by these studies, such teaching cannot, according to the enlarged views of modern times, compose a complete intellectual culture. . . . As the best sciences which the ancient world framed supplied the best elements of intellectual education up to modern times, so the grand step by which, in modern times, science has sprung up into a magnitude and majesty far superior to her ancient dimensions should exercise its influence upon modern education, and contribute its proper result to modern intellectual culture."

Happily the further discussion has been postponed until Michaelmas Term; by that time it is hoped that some method will be found by which natural science will be honoured without hurting the feelings of any one. We may state that the Council of the Cambridge Senate recommend to the Commissioners that power be given in the statute to recommend degrees in science (B.Sc., M.Sc., D.Sc.).

ON SOME MARINE ALGÆ[1]

THE successor of Harvey in the Chair of Botany in the University of Dublin has taken, as his eminent predecessor did, the algæ for the principal object of his study. In 1877 Dr. E. P. Wright published in the *Transactions* (vol. xxvi. Science) of the Royal Irish Academy two memoirs, one on a green unicellular alga (*Chlorochytrium Cohnii*) parasitic in the mucous tubes of some diatoms, in *Polysiphonia urceolata*, and in *Calothrix confervicola*; the other on a parasite deprived of chlorophyll (*Rhizophydium Dicksonii*), which develops itself in the cells of an Ectocarpus, and which has been taken, at least in one case (*E. crinitus*, Harv.), for the fruit of an Ectocarpus. This present year the *Transactions* of the same Academy contain two additional memoirs by the same author, which are accompanied by three coloured plates drawn by Tuffen West. The latter memoirs seem to me to be conceived in a spirit, and executed after a manner, which one does not always meet with in the writings of the British algologists. Dr. Wright has studied the living plants, an innovation on which he cannot be too much congratulated. One would only wish that his exact and minute observations on the development of organs, a subject in which he has shown himself at home, had been joined to an experimental determination of their functions, a determination which morphology by itself is powerless to declare to us. It is easy to prove this latter statement by a few instances taken from authors whose abilities have been placed beyond all doubt. Thus it has been said over and over again—Naegeli himself believes it ("Algensysteme," p. 134, Pl. 1, Fig. 34; 6)—that the heterocysts of the Nostocs are reproductive bodies, while experiments the most easily made prove that they are nothing of the sort. Cramer ("Phys. syst. Untersuch. über die Ceramieen," Heft 1, p. 125) has mistaken the antheridia of Bonnemaisonia for young cystocarps. Dr. Wright has, as we will show further on, been himself the victim of a similar error. Morphology is not like the spear of Achilles; it does not heal the wounds which it makes.

Griffithsia setacea is a pretty, red alga, well known to

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[1] From the French of Ed. Bornet.